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Biedscheid

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(54) **FLOATING AIRCRAFT ARCHWAY AND METHOD THEREFOR**

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B64D 11/00 (2006.01)
B64C 1/06 (2006.01)

(52) **U.S. Cl.**
CPC .. ***B64D 11/00*** (2013.01); ***B64C 1/06*** (2013.01)

(58) **Field of Classification Search**
CPC B64D 11/04; B64D 2011/0046; B64C 1/068; B64C 1/06; B64C 2001/00
USPC 244/118.5, 118.6, 117, 118.1, 118.2, 244/119
See application file for complete search history.

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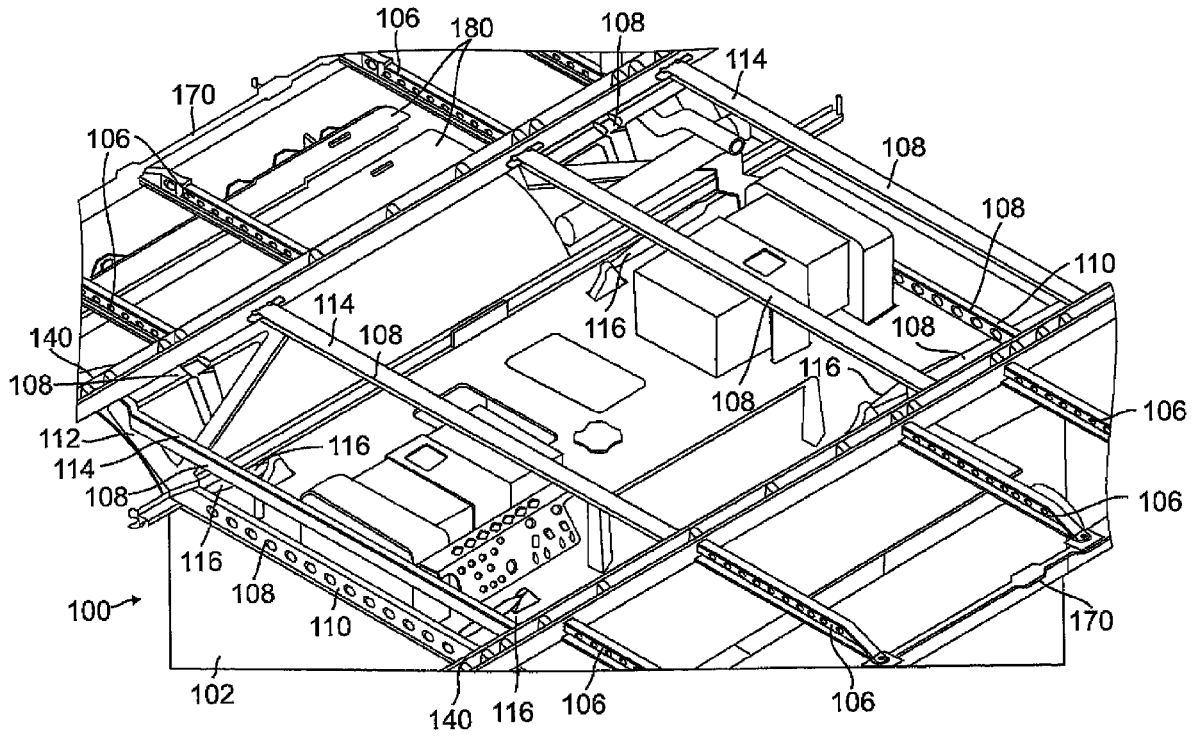
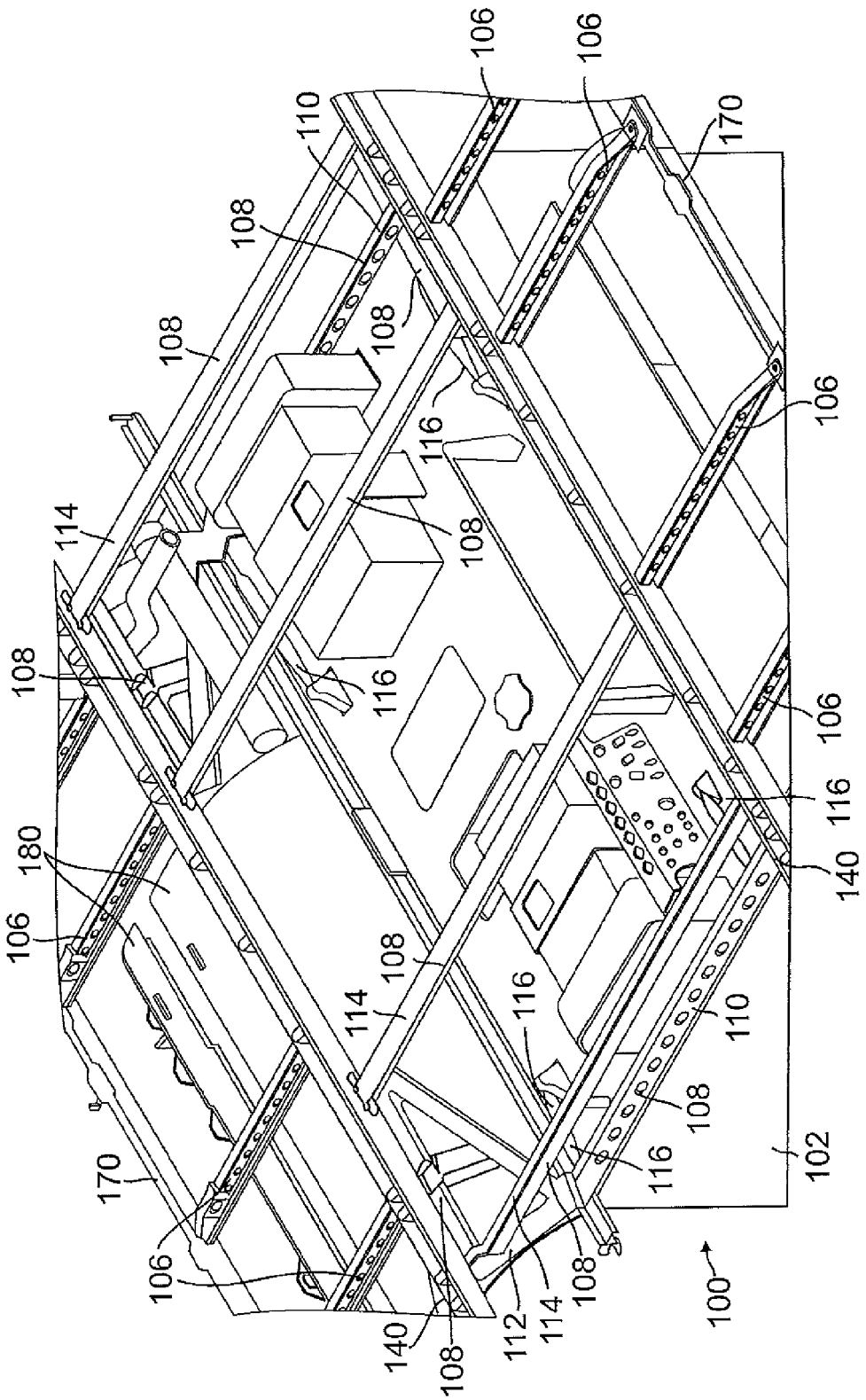
(57) **ABSTRACT**

A floating archway within an aircraft attaches to a lattice section, a plurality of support members and a plurality of tie rods coupling the lattice section to the plurality of support members.

20 Claims, 14 Drawing Sheets

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106
110
170
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180
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110
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102
170
116
106
108
112
114
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140
108
100

FIG. 1

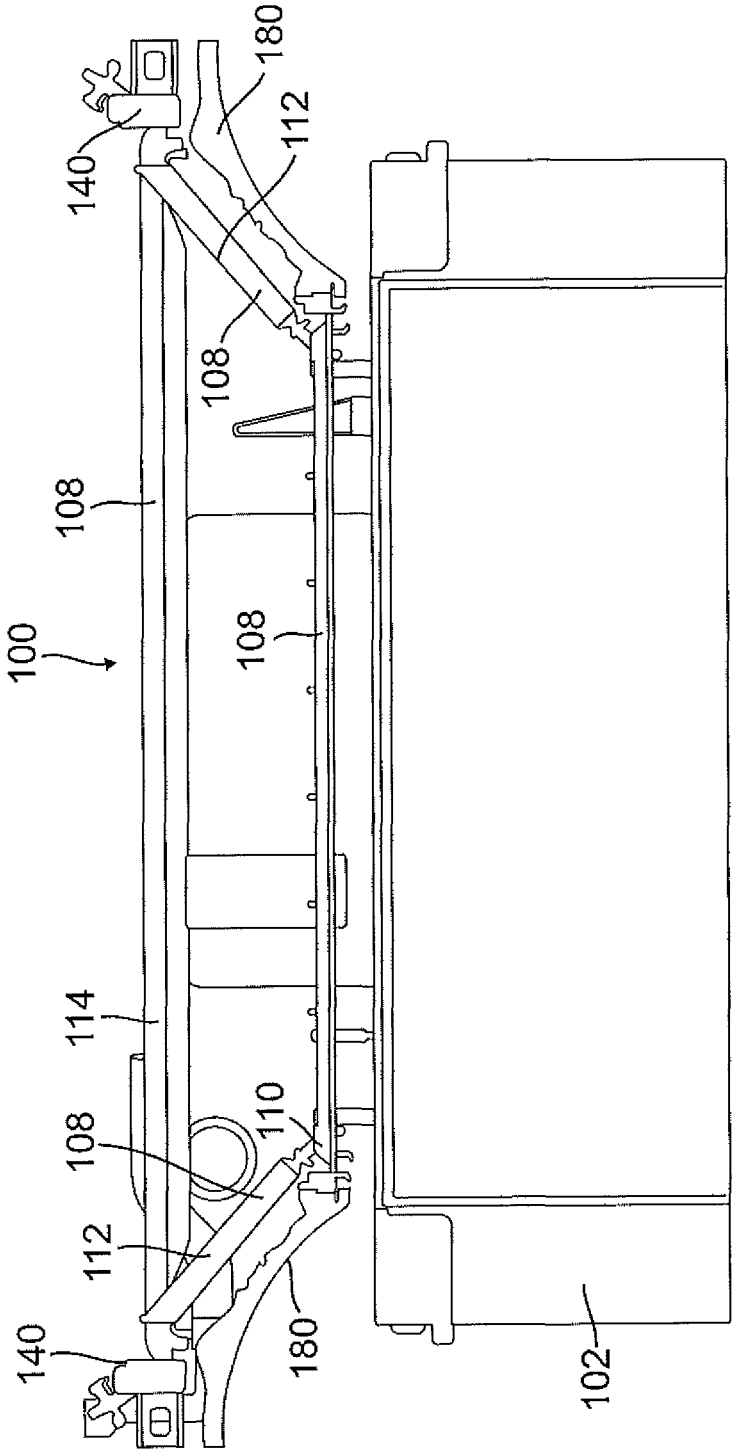


FIG. 2

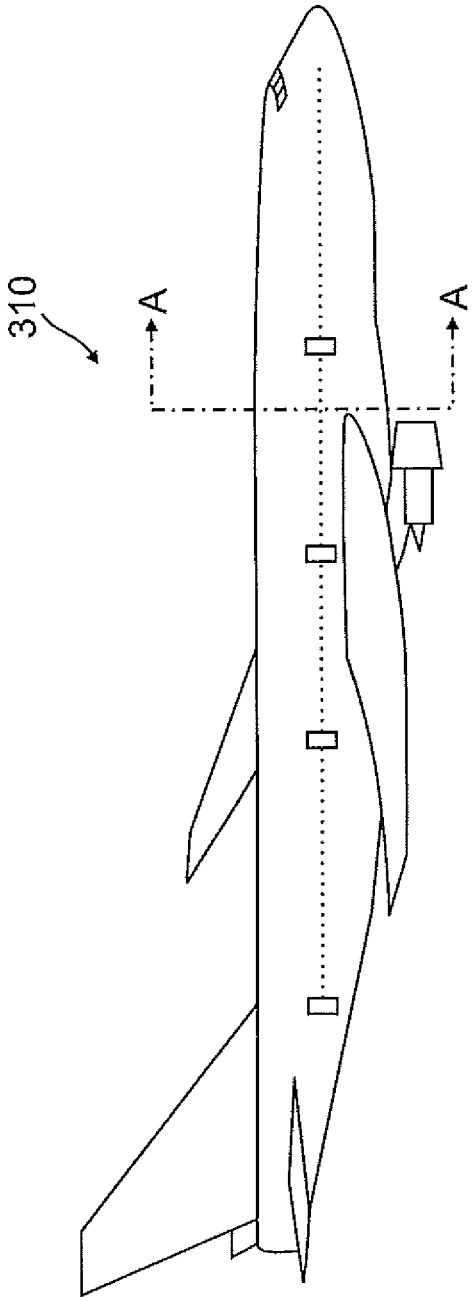


FIG. 3

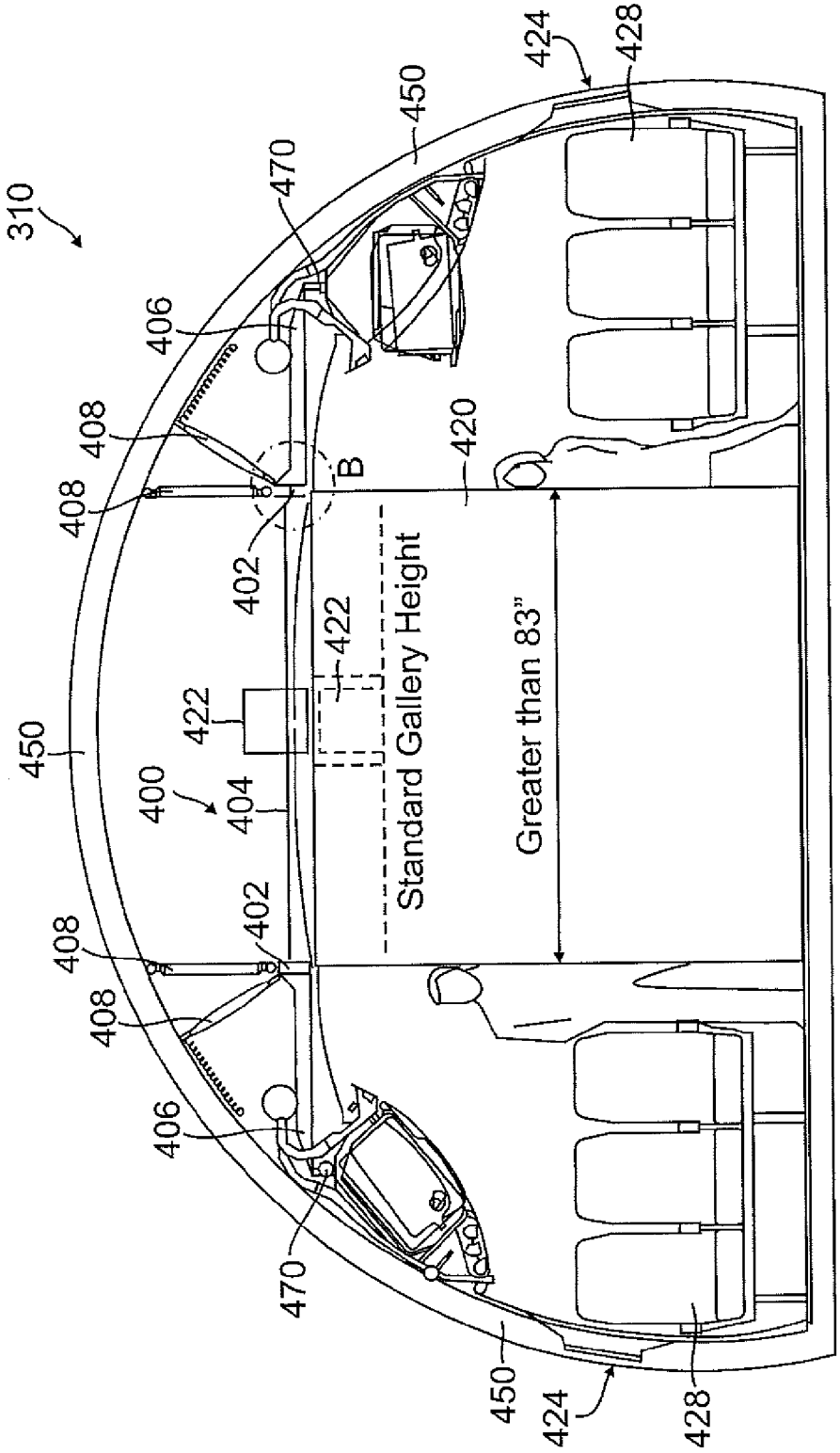
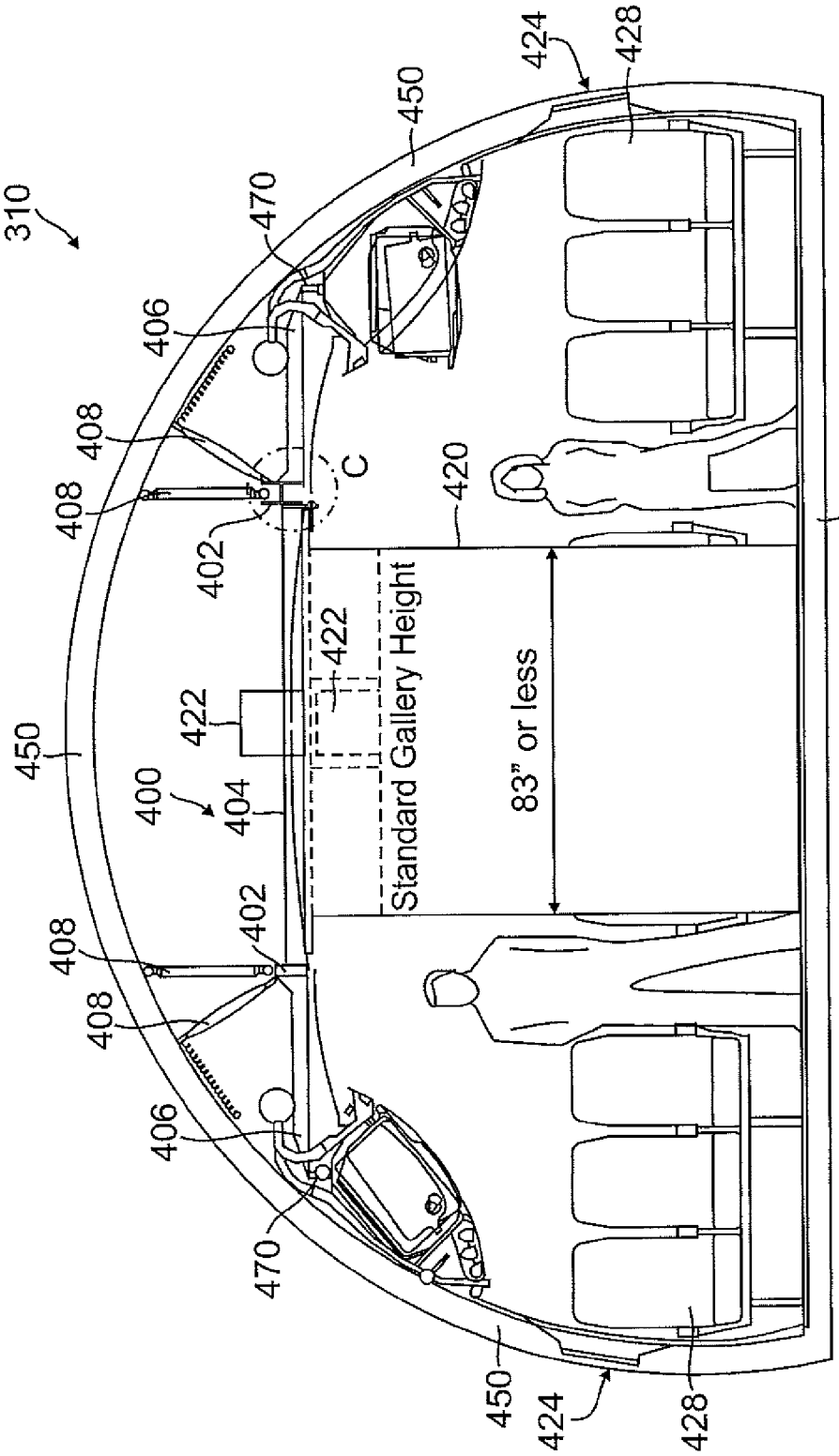

310
450
424
428
470
406
408
420
B
402
422
Standard Gallery Height
Greater than 83"
400
404

FIG. 4A


310
450
424
428
470
406
408
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420
426
402
422
Standard Gallery Height
83" or less
400
404

FIG. 4B

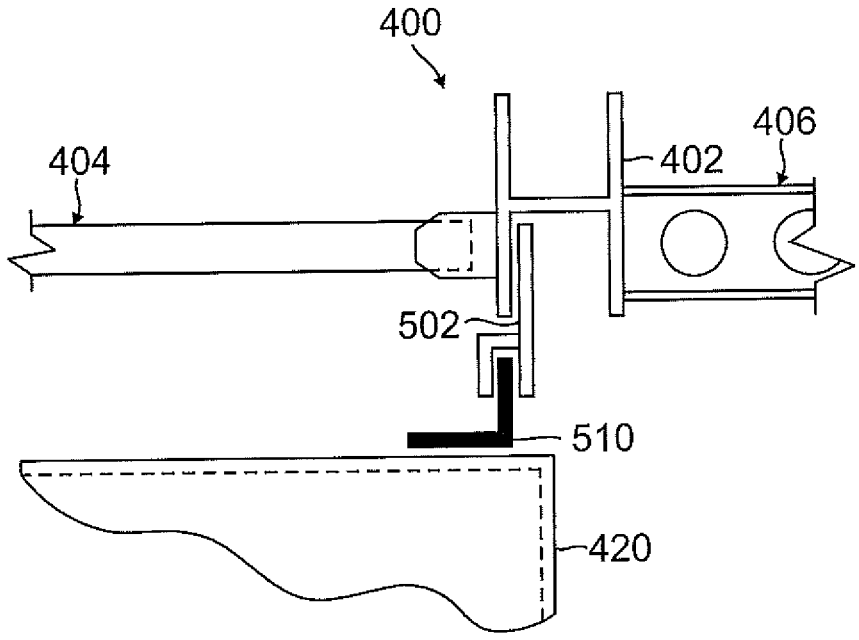

FIG. 5

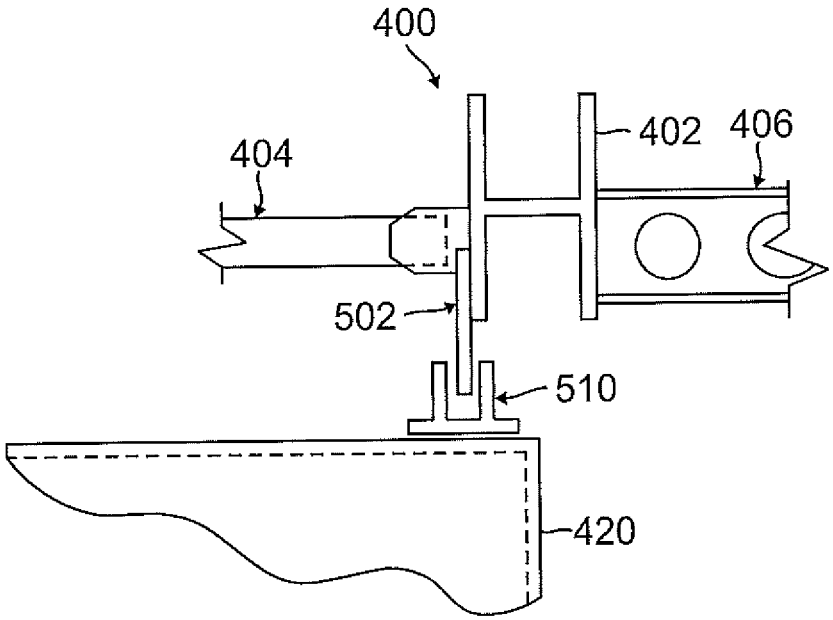

FIG. 6

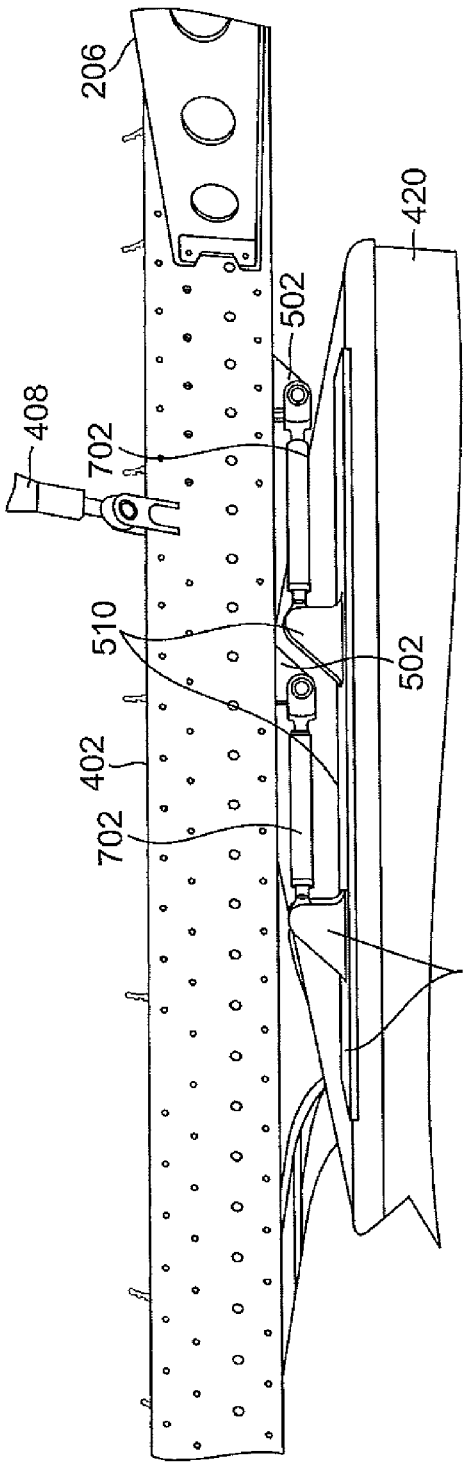
206
420
502
408
702
510
502
402
702
510

FIG. 7

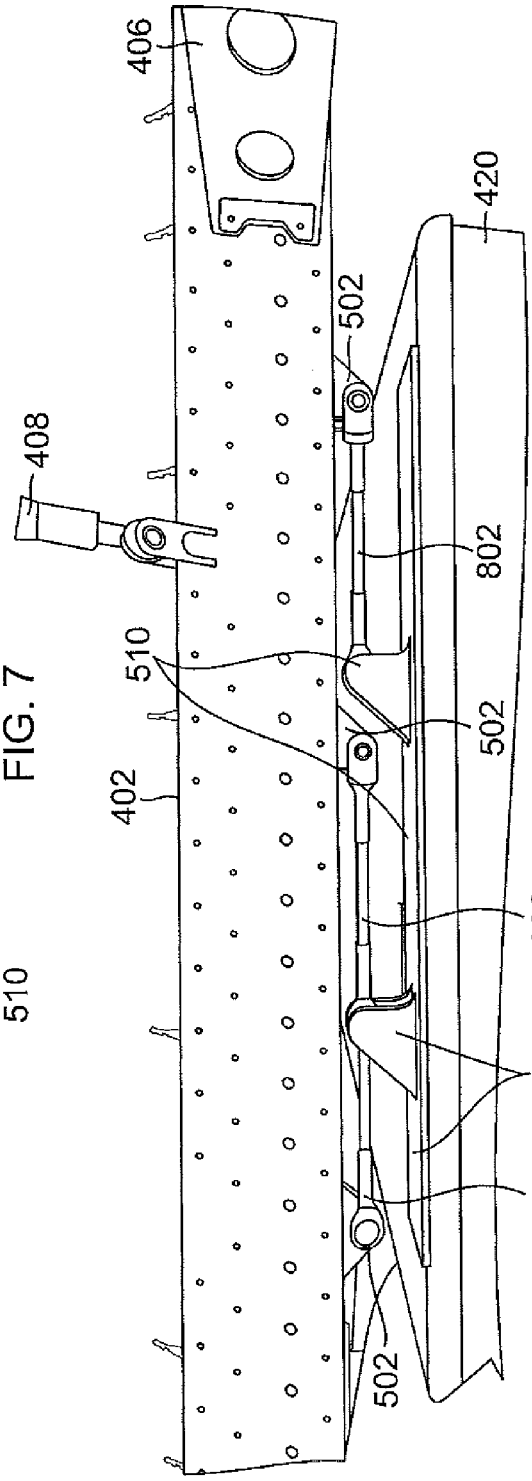
406
420
502
408
802
510
502
402
802
510
802
502

FIG. 8

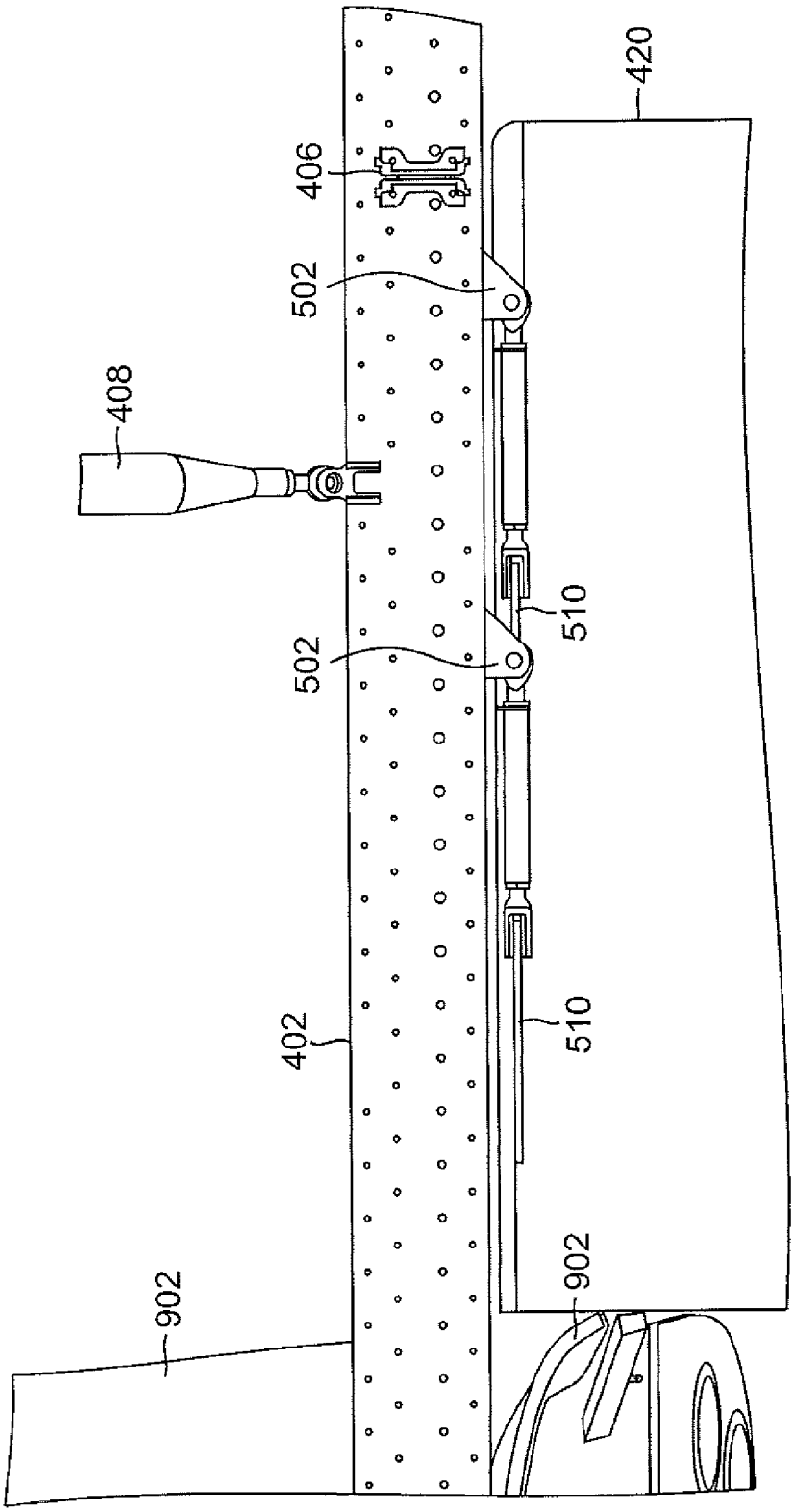

FIG. 9

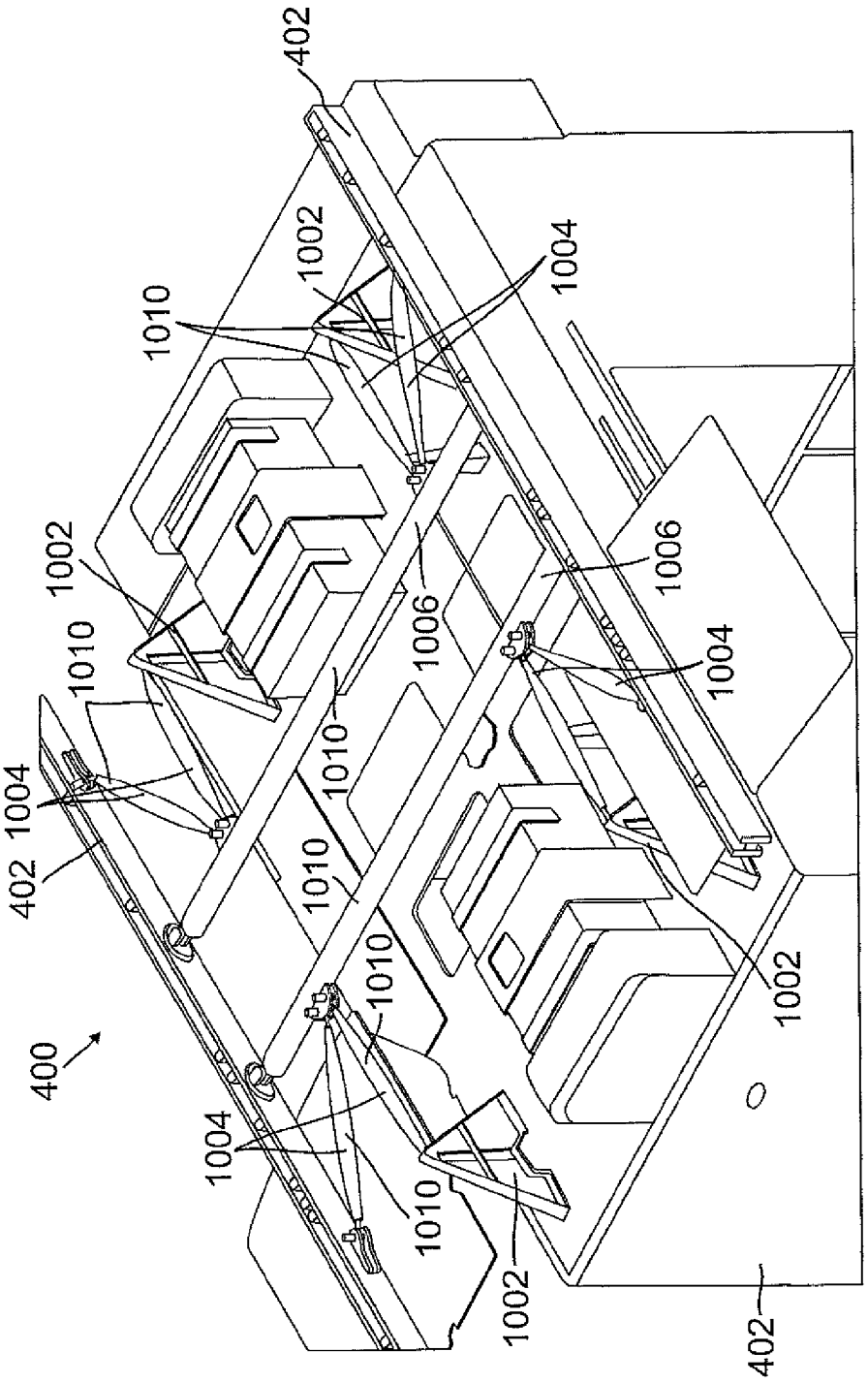

FIG. 10

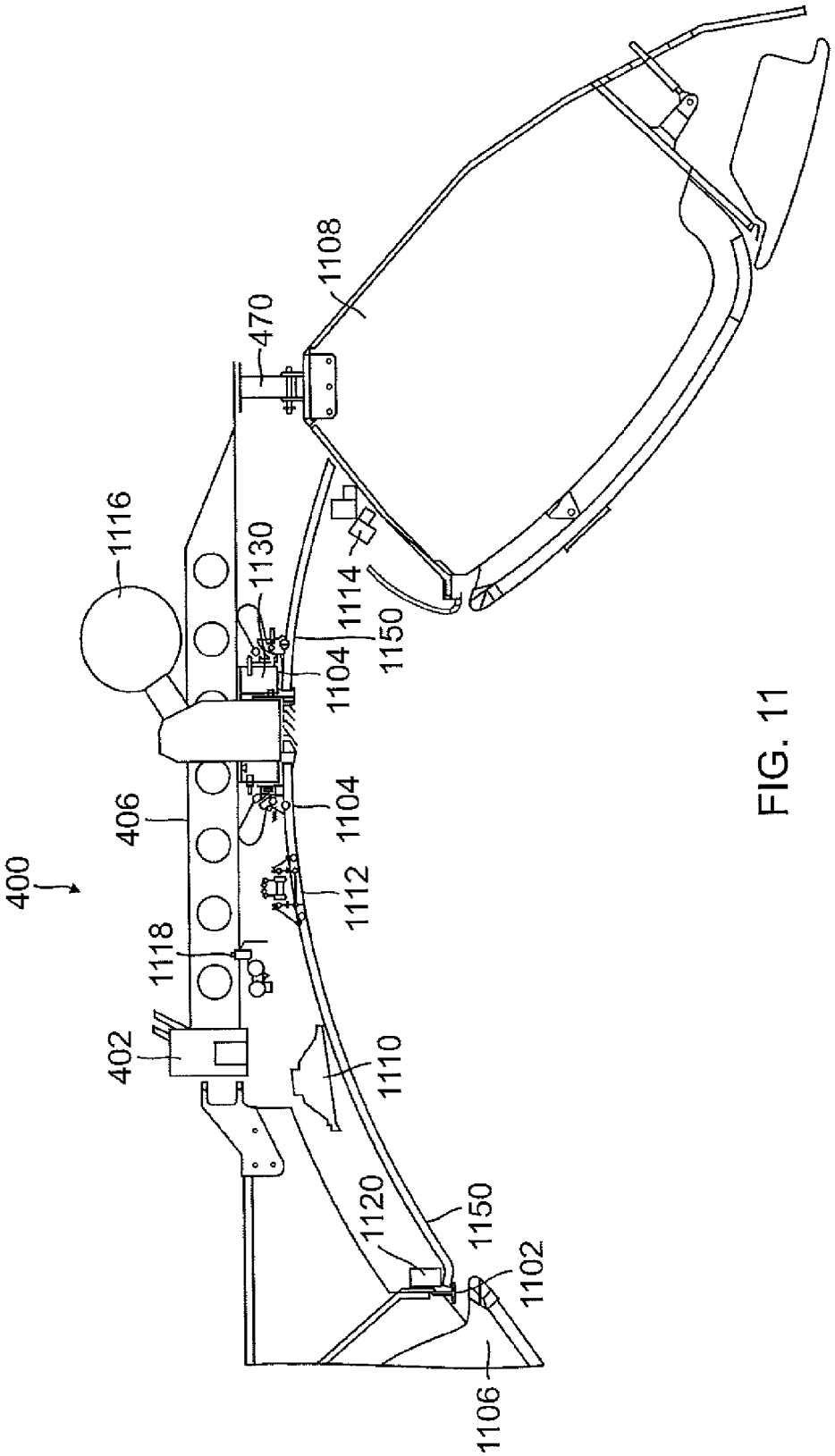
400
402
406
470
1102
1104
1106
1108
1110
1112
1114
1116
1118
1120
1130
1150

FIG. 11

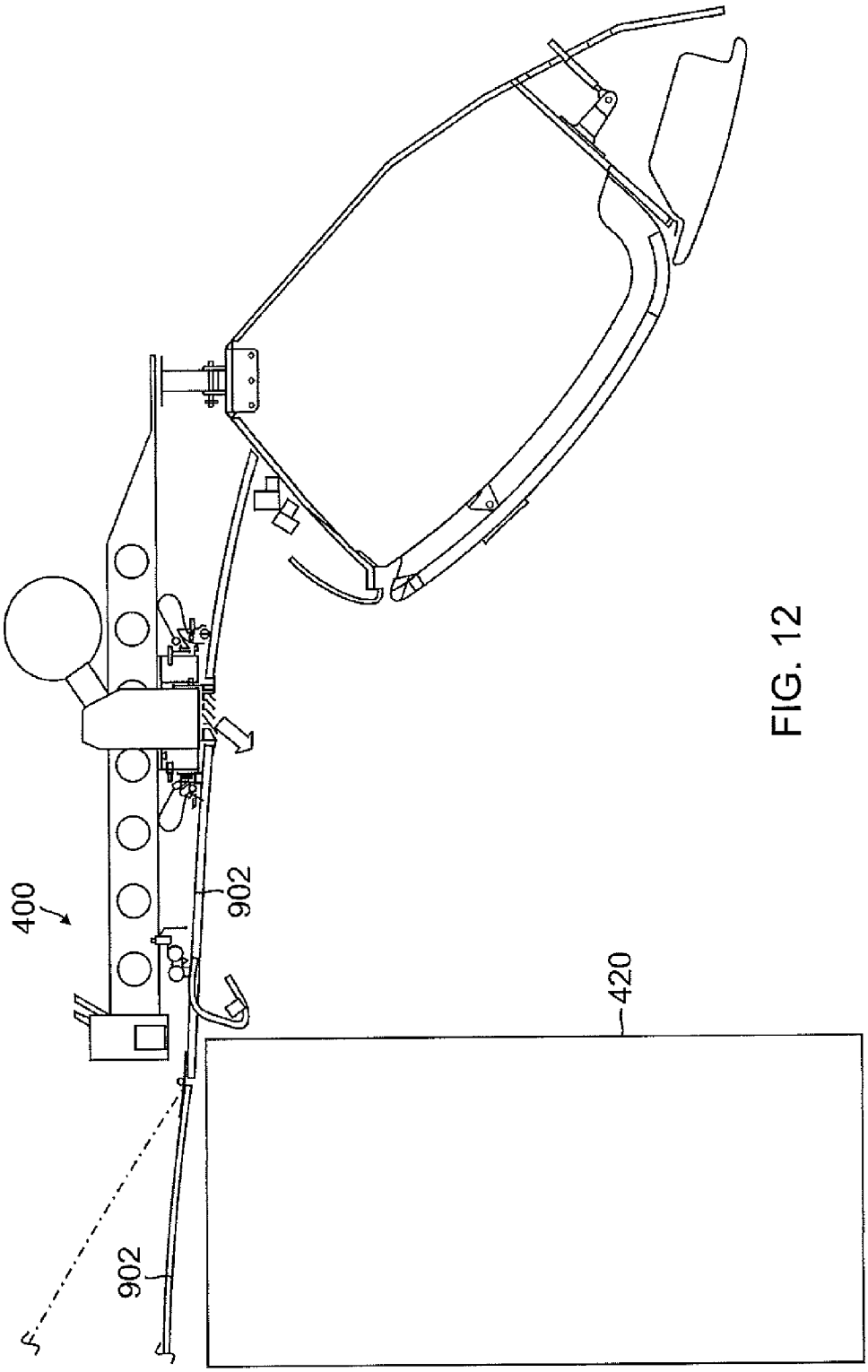

FIG. 12

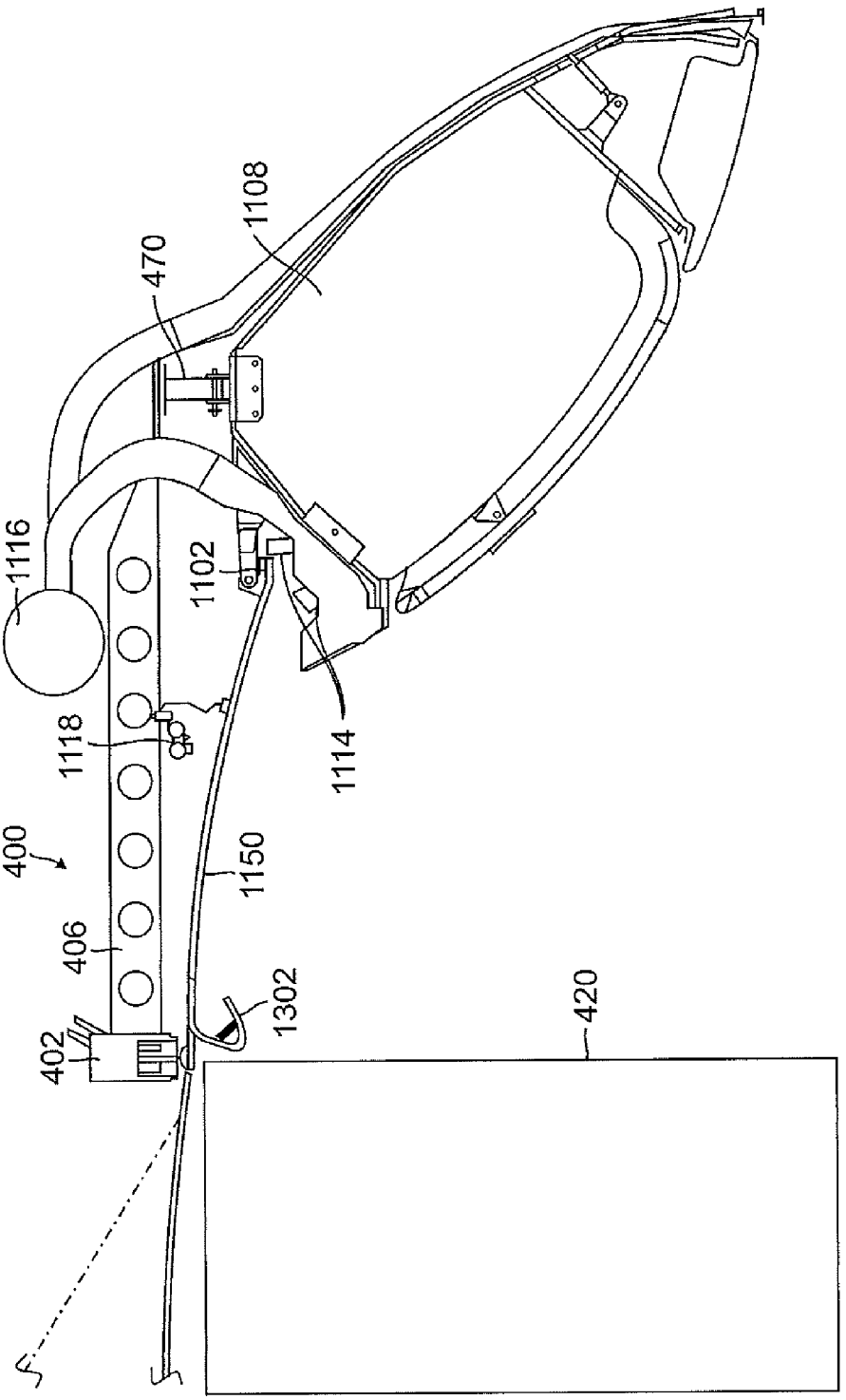

FIG. 13

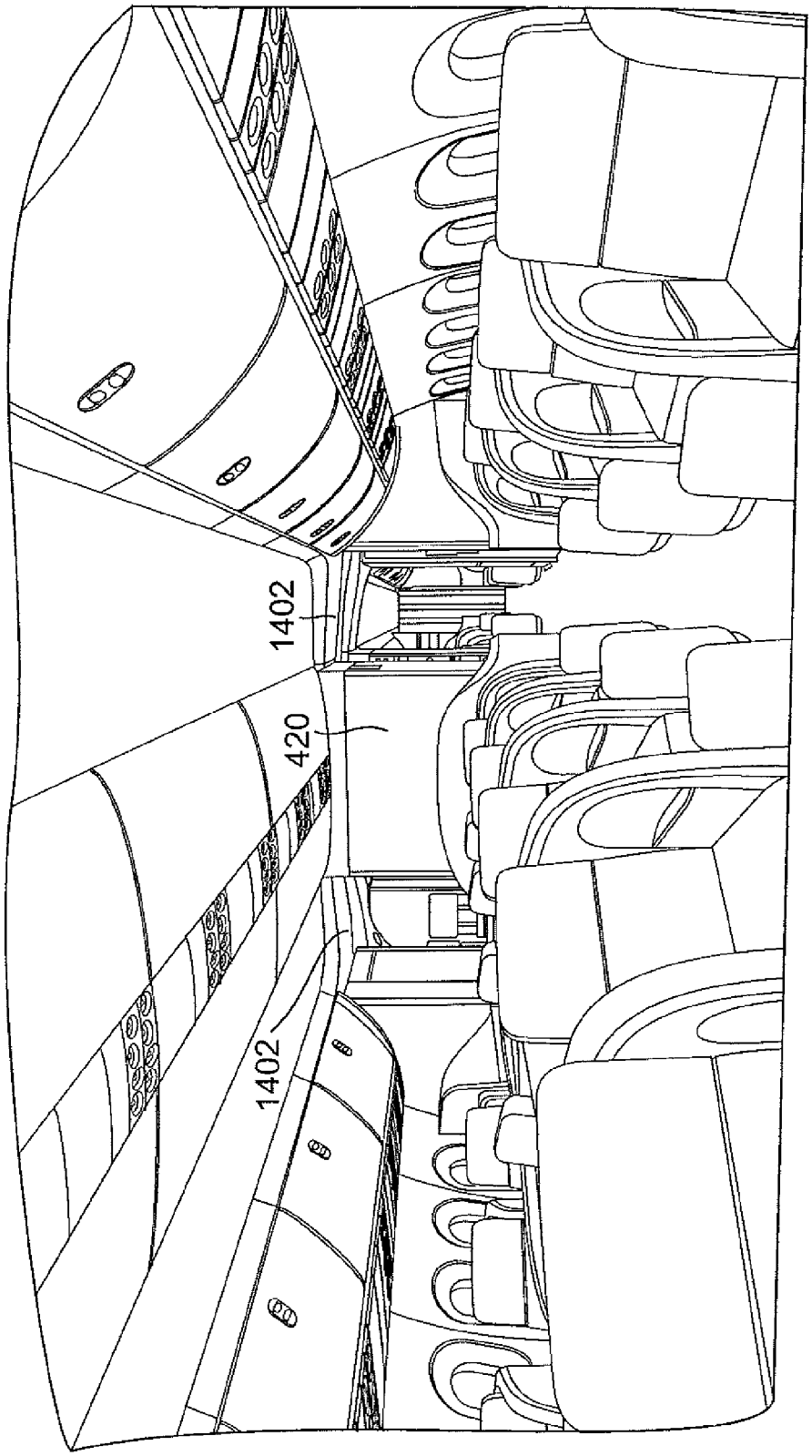

FIG. 14

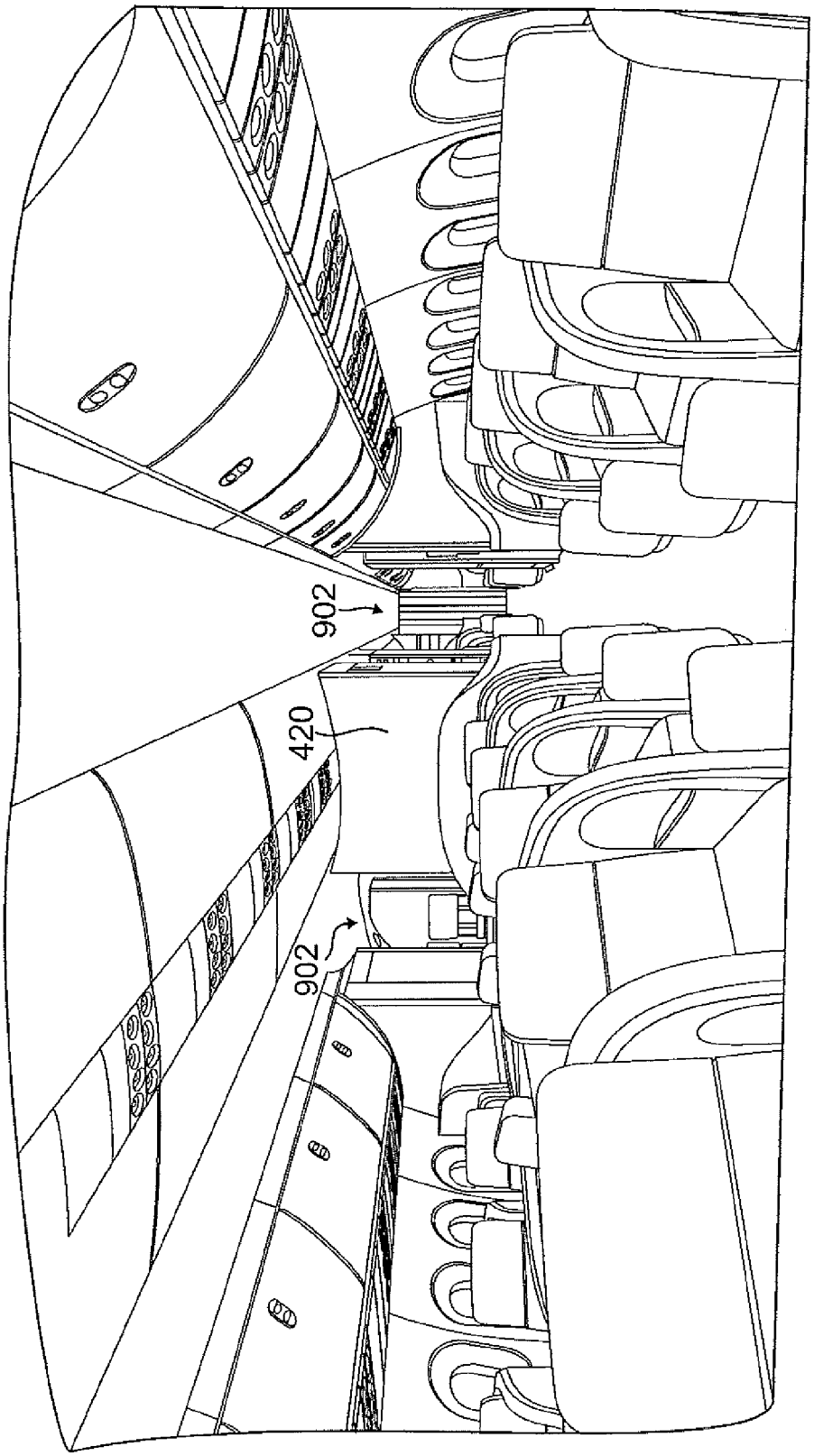

FIG. 15

FLOATING AIRCRAFT ARCHWAY AND METHOD THEREFOR

BACKGROUND

Embodiments of this disclosure generally relate to an aircraft, and more particularly, to a structure coupled to the aircraft that may be used to remove existing trusses and a floating archway ceiling to expand an overall look and feel of a cabin.

Referring to FIG. **1**, an isometric view of a galley monument support **100** with trusses **108** is provided. The trusses **108** may include one or more triangular units constructed with straight members **114** whose ends may be connected to rails **140**. The truss **108** may be provided in three dimensions with a lower section **110** of the truss connected to the monument **102** via tie rods **116**. The truss **108** may include angular sections **112** that provide support to the lower section **110** of the truss **108**.

The monument **102** coupled to the support **100** may be connected by a number of tie rods **116**. The existing rails **140** may span the length of the aircraft. Cross bars **106** may be positioned along the length of the aircraft. The cross bars **106** may couple the rails **140** to the outboard rails **170**. Ceiling panels **180** can be connected to the support **100**.

FIG. **2** is a side view of the support **100** of FIG. **1**. As shown, the trusses **108** may be connected to the rails **102** through the straight members **114**. The angular sections **112** as well as the lower section **110** of the trusses **108** may then be coupled to the monument **102**. The ceiling panels **180** may be arched which correspond to the angular sections **112** of the galley monument support **100**.

In many aircraft, the monument **102** may be a heavy item. The monument **102** may tend to roll over under forward loading conditions. Trusses **108** may prevent these conditions for monuments **102**. Trusses **108** may define the structure and therefore the interior of an aircraft. Current trusses **108** may limit the height of the monument **102** within the aircraft. Current archways may be fixed about the door centerline and create aesthetic issues since many main deck monuments, like galleys, may not reside symmetrically about the door centerline.

The trusses **108** may limit the height of the monument **102** within an aircraft and may be structurally inefficient. Accordingly, by removing trusses **108**, there may exist the potential to add more seats within the aircraft. For example, the overhead area opened up by removing trusses may be used to store carts freeing up additional main deck space for seats or to add seats directly in the overhead space in the form of current **777** overhead crew rests.

Other benefits of removing trusses **108** may include reducing weight to the aircraft. Trusses **108** may weight forty to fifty pounds or more with four to six trusses **108** within each aircraft. The interior weight of an aircraft may be reduced by up to 150 lbs. Furthermore, trusses **108** may be expensive to produce and install within the aircraft. Finally, the use of trusses **108** may result in higher fuel costs than if they were not present.

As such, by removing the trusses **108**, and using other components, the final product costs may be reduced. Therefore, it would be desirable to provide a system and method that overcomes the above problems while enhancing the interior look and feel of the aircraft.

SUMMARY

A structure for securing a galley has a first rail extending longitudinally and a second rail extending longitudinally.

Fastening members from the first and second rails are connected with fittings on the galley through tie rods or cables.

A floating archway within an aircraft attaches to a lattice section, a plurality of support members and a plurality of tie rods coupling the lattice section to the plurality of support members.

A method for configuring an aircraft cabin comprising: attaching fastening members to first and second rails; and securing the fastening members to fittings on at least one galley through tie rods or cables.

The features, functions, and advantages may be achieved independently in various embodiments of the disclosure or may be combined in yet other embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the disclosure will become more fully understood from the detailed description and the accompanying drawings, wherein:

FIG. **1** is an isometric view of a galley monument support with trusses;

FIG. **2** is a side view of the support of FIG. **1**;

FIG. **3** is a side view of an exemplary aircraft;

FIGS. **4**A and **4**B are cross-section views of the exemplary aircraft taken along line A-A as shown in FIG. **3**;

FIG. **5** is a closer sectional view of an aircraft super galley fitting taken within circle B as shown in FIG. **4**A;

FIG. **6** is a closer sectional view of another aircraft super galley fitting taken within circle B as shown in FIG. **4**A;

FIG. **7** is a side view of the aircraft super galley fitting;

FIG. **8** is a side view of another aircraft super galley fitting;

FIG. **9** is a side view of another aircraft super galley fitting with a floating archway taken from the right side of circle C as shown in FIG. **4**B;

FIG. **10** is an isometric view of a different style of truss structure of the exemplary aircraft;

FIG. **11** is a view of the lattice structure in the exemplary aircraft having multiple ceiling panels;

FIG. **12** is representative side view of a floating archway and super galley residing in a multiple ceiling panel exemplary aircraft;

FIG. **13** is a view of the lattice structure in the exemplary aircraft having a single ceiling panel;

FIG. **14** is an interior view of the exemplary aircraft showing archway architecture; and

FIG. **15** is an interior view of the exemplary aircraft showing a floating archway ceiling.

DETAILED DESCRIPTION

Turning to FIG. **3**, a side view of an exemplary aircraft **310** is provided. An archway placed within the aircraft **310**. The archway of the aircraft **310**, as disclosed herein, may be referred to as a floating archway. The archway may reduce costs and result in modifications to system transport elements, such as electrical wiring, water lines, or environment control system ducts. The archway may be placed in between galleys or super galleys.

In one exemplary embodiment, one or more floating archways may be provided within the aircraft **310**. Aesthetically, the archway may provide a more open feel as well as increase cabin space. The archway may allow components to be raised. By using floating archways and super galleys, the arch shaped paneling provided as a cover up within the interior may be removed.

By using a floating archway, an aircraft chiller may be elevated by, for example, one or more feet without using a

truss structure. Furthermore, a floating archway may provide a more integrated look for outboard lavatories or galley monuments. In this regard, system connections servicing these monuments may be readily accessible. Advantageously, additional galley storage area may be made available in a super galley.

FIGS. **4**A and **4**B are cross sectional views of the exemplary aircraft **310** taken along line A-A as shown in FIG. **3**. Other cross sections may be taken along the length of the aircraft **310** that may show other or additional features. The lattice structure **400** above the archway may include, but is not limited to, rails **402**, beams **404**, cross bars **406** and coupling members **408**. The lattice structure **400** may also include outboard rails **470** which may be coupled to the rails **402** through a number of cross bars **406**. Similar to the rails **402**, the outboard rails **470** may extend the length of the aircraft **310** or a portion thereof.

Before describing the particular components within the lattice structure **400**, features of the interior of the aircraft **310** are disclosed. The lattice structure **400** may span over a galley or super galley **420**. The galley **420** may extend from one aisle **428** to another. The height of the galley **420** may begin at the floor **426** of the aircraft **310** to approximately the bottom of the lattice structure **400**.

In FIGS. **4**A and **4**B, entryways **424** may be placed on the sides of the aircraft frame **450**. Windows or other features may be placed or embedded between the frames **450**. The aircraft frame **450** may have an arcuate shape. The frame **450** may be made of composite materials. Other system components may be secured through the lattice structure **400**. As will become apparent from the description provided below, the chiller **422** or other components may be raised by removing trusses. In one embodiment, the chiller **422** may be raised by a foot.

Referring now to the lattice structure **400**, the rails **402** may have an H-shape and extend longitudinally across the length of the aircraft **310**. The rail **402** may have an H-shape at portions or the entire length of the rail **402**. The rails **402** may incorporate class 3 size holes. These holes may be used to connect cross bars **406**. The holes may also be used to couple beams **404**. The rails **402** may be pre-existing in many aircraft **310**.

The lattice structure **400** may also include beams **404**. Many beams **404** may be used. The beams **404** may extend between a first rail **402** and second rail **402** within the lattice structure **400**. The beams **404** may be spaced apart across different portions of the rails **402** to provide support for the right side of the lattice structure **400** at multiple places. The beams **404** may be coupled to the class 3 size holes of the rails **402**. Through the rails **402**, cross bars **406**, outboard rails **470**, coupling members **408** and beams **404**, a lattice structure **400** may be formed.

Cross bars **406** may extend radially outward from the rails **402**. As depicted, the cross bar **406** may be coupled to an outboard rail **470**. One or many cross bars **406** may be coupled along the length of the rails **402**. The cross bars **406** may provide tensile strength to the lattice structure **400**.

The lattice structure **400** may also include coupling members **408**. The coupling members **408** may be tie rods that may be positioned perpendicularly to the cross bars **406** or at an angle as shown in FIGS. **4**A and **4**B. The coupling members **408** may be connected to a top portion of the aircraft frame **450**. In one embodiment, a single set of coupling members **408** may be used that are perpendicular to the cross bars **406**.

Referring to FIGS. **5** and **6**, with super galleys wider than 83", an expanded view of the super galley fitting taken along circle B of FIG. **4**A is shown. The rail **402**, as described before, may take on an H-shape. A fastening member **502** may be coupled to the rail **402**. A super galley fitting **510** may then be tied to the fastening member **502** through tie rods or cables, which will be described in more detail below. FIG. **4**B (super galleys 83" wide or less) is an additional cross sectional view with similar circle B components.

FIG. **5** provides a closer sectional view of the aircraft **310** taken within circle B as shown in FIG. **4**A. In the shown embodiment, the rail **402** has an H-shape. The H-shaped rail **402** may be attached to the top of the aircraft frame **450** through coupling members **408**, not shown. The coupling members **408** may be positioned perpendicular to the beams **404** and cross bars **406** or at an angle. In turn, the beam **404** may be coupled to at least one rail **402**. Crossbars **406** may be coupled to the rail **402**.

A fastening member **502** may be coupled to a rail **402** and super galley fitting **510**. Tie rods or cables may be used to connect the fastening members **502** and super galley fittings **510** as shown in FIGS. **7**, **8** and **9**. The super galley **420** and components within the super galley **420** may be secured through the lattice structure **400**. Through the fastening members **502** and super galley fittings **510**, there may be small to no vertical or side loads.

The fastening member **502**, shown in FIGS. **5** and **6**, may come in multiple pieces. The fastening member **502** may have two parallel extensions for placement of a tie rod or cable therebetween. Alternatively, the fastening member **502** may come in a single piece, while the super galley fitting **510** may have two parallel extensions for securing the tie rod or cable as shown in FIGS. **7**, **8** and **9**. The super galley fitting **510** may be adapted to the fastening member **502**.

A floating archway may blend in with the main aisle way ceiling. This may enable a continuous look throughout the aircraft **310**. The super galley **420**, fastening member **502**, super galley fitting **510** plus tie rods or cables may eliminate trusses that were placed between the rails **402**. Each of these components may effectively be coupled to the lattice structure **400**.

The galley fittings **510** on top of the super galleys **420** may provide a relatively flat surface. The floating archway ceiling may aesthetically blend in between super galleys **420** and the main aisleway ceilings. The floating archway ceiling may be coupled to the lattice structure **400**.

Turning to FIG. **7**, a side view of the aircraft super galley fitting **510** is provided. Described above, the rail **402** may be connected to the aircraft frame **450** through coupling members **408**. The rail **402** may also be connected to cross bars **406** extending perpendicularly. The super galley fitting **510** may be coupled to a fastening member **502**, which may be coupled to the rails **402**. The fastening member **502**, or a portion thereof, may extend slightly below the rail **402**. More than one fastening member **502** may be used.

The super galley fitting **510** may be coupled to the fastening member **502** through one or more tie rods **702**. These tie rods **702** may be placed parallel to the rail **402** and the super galley **420**. The super galley fitting **510** may extend below the tie rods **702** or at least a portion thereof. The super galley fitting **510** may be a machined fitting, which may be coupled to the super galley **420**.

FIG. **8** is a side view of another aircraft super galley fitting **510**. The super galley fitting **510** may be coupled to the fastening member **502** through one or more cables **802**. These cables **802** may be placed parallel to the rail **402** and the super galley **420**.

For the super galley **420**, multiple fastening members **502** may be used with multiple super galley fittings **510**. The members **502** may be placed away from the super galley

fittings **510** and coupled to one another through the tie rods **702** or cables **802**. FIG. **9** is a side view of an aircraft super galley **420** taken from the right side of circle C of FIG. **4**B and depicts a portion of a floating archway **702**. FIG. **9** depicts a method of super galley attachment for super galleys 83" in width or less. Multiple galleys **420** may exist within the aircraft **310** and be connected as described above. Between the galleys **420** may exist floating archways **902**.

Turning to FIG. **10**, an isometric view of a lattice structure **400** of the exemplary aircraft **310** may be shown with a different type of truss structure. Advantageously, truss structure **1010** coupled to the lattice structure **400** may essentially replace the trusses **108** shown in FIG. **1** and yet still provide the same benefits. A properly configured super galley **420** and its attachment methods to the lattice **400** may eliminate tripod supports **1002** and truss structure **1010** in favor of a much lighter and more efficient structure.

Referring to FIG. **11**, a closer view of the lattice structure **400** in the exemplary aircraft **310** having multiple ceiling panels **1150** is provided. The structure **400** may extend from an inboard bin **1106** to an outboard bin **1108**. The rail **402**, cross bar **406** and outboard rail **470** are shown. The ceiling panels **1150** may be coupled to the lattice structure **400**. The ceiling panels **1150** may nest to a multi-purpose rail **1102** and then latches **1104** and **1120** to secure them. While the ceiling panels **1150** may be positioned as shown, the floating archway may take on many forms.

Speakers **1110** and emergency lights **1112** may be embedded through the ceiling panels **1150**. Other components within the ceiling panels **1150** may include bin and ceiling lights **1114**. The ceiling panels **1150** may have an environmental control system **1116** nearby. Gaseous oxygen **1118** may be nearby. These components may be secured through the ceiling panels **1150** themselves or through the lattice structure **400**. FIG. **12** is representative side view of a floating archway **902** and super galley **420**. The floating archway **902** and super galley **420** may be coupled to the lattice structure **400** through those fittings described above.

FIG. **13** is a closer view of the lattice structure **400** in the exemplary aircraft **310** having a single ceiling panel **1150**. In one embodiment, a super galley **420** may be tied to structure **400** and on the other side an outboard bin **1108**. The ceiling panel **1150** may be coupled to the bin **1108** through a hinge **1102**. The ceiling panel **1150** may contain a valence **1302**. Gaseous oxygen **1118** may be nearby as well as bin and ceiling lights **1114**. The ceiling panel **1150** may have an environmental control system **1116** nearby.

In the embodiments shown in FIGS. **12** and **13**, the trusses **108** of FIG. **1** may be removed. By eliminating them, a ceiling archway may be raised allowing an open feel. In one embodiment, new aircraft **310** may directly incorporate the lattice structure **400**. The lattice structure **400** may also be implemented within post production aircraft **310** and super galleys **420** plus floating archways **902** may be retrofit in them.

The lattice structure **400**, described above, may be manufactured using a variety of techniques and materials. In older aircraft **310**, trusses **108** may be coupled to the rails **402**. The trusses **108** may be removed from the rails **402** and super galleys **420** plus floating archways **902** may be retrofit in them.

FIG. **14** is an interior view of the exemplary aircraft **310** showing arches **1402** with a standard size galley or monument **420**. FIG. **15** is an interior view of the exemplary aircraft **310** showing a floating archway **902** ceiling and super galley **420**. The floating archway **902** expands the cabin space with the super galley **420** and provides a friendlier environment.

While embodiments of the disclosure have been described in terms of various specific embodiments, those skilled in the art will recognize that the embodiments of the disclosure may be practiced with modifications within the spirit and scope of the claims.

What is claimed is:

1. A structure for securing an aircraft structure comprising:
- a first rail extending longitudinally;
- a second rail extending longitudinally;
- a plurality of tie rods to attached the first rail and the second rail to a frame of an aircraft housing the structure;
- plurality of cross bars, wherein the plurality of cross bars comprises:
  - a first cross bar having a first end connected to the first rail and a second end connected to a first outboard rail; and
  - a second cross bar having a first end connected to the second rail and a second end connected to a second outboard rail; and
- fastening members connected to the first and second rails;
- a fitting connected to the fastening members through tie rods or cables, the fitting having a substantially flat surface contacting the super galley; and
- a plurality of members extending between the first rail and the second rail and approximately planer to the super galley.

2. The structure of claim **1**, wherein the first and second rails are H-shaped.

3. The structure of claim **1**, wherein the first and second rails include class 3 size holes, the class 3 size holes configured to receive the tie rods or cables to couple the plurality of cross bars to one of the first cross bar or second cross bar.

4. The structure of claim **1**, wherein the first and second rails extend across a length of an aircraft.

5. The structure of claim **1**, wherein the first and second rails are parallel to each other.

6. The structure of claim **1**, wherein the fastening members have two parallel extensions with the tie rods or cables placed therebetween.

7. The structure of claim **1**, wherein the fittings have two parallel extensions with the tie rods or cables placed therebetween.

8. The structure of claim **1**, wherein the tie rods or cables are parallel to the first and second rails and the super galley.

9. A structure for securing an aircraft structure comprising:
- a first rail extending longitudinally;
- a second rail extending longitudinally;
- a plurality of coupling members to attached the first rail and the second rail to a frame of an aircraft housing the structure;
- a first cross bar having a first end connected to the first rail and a second end connected to a first outboard rail; and
- a second cross bar having a first end connected to the second rail and a second end connected to a second outboard rail;
- fastening members connected to the first and second rails;
- a plurality of fittings, one fitting connected to each of the fastening members and to the super galley; and
- a plurality of members extending between the first rail and the second rail and approximately planer to the super galley.

10. The structure of claim **9**, wherein the fitting has a substantially flat surface contacting the super galley.

11. The structure of claim **9**, wherein the first and second rails are H-shaped.

12. The structure of claim **9**, wherein the first and second rails include class 3 size holes, the class 3 size holes config-

ured to receive one of tie rods or cables to couple the plurality of cross bars to one of the first cross bar or second cross bar.

13. The structure of claim **9**, wherein the fastening members have two parallel extensions with tie rods or cables placed therebetween.

14. The structure of claim **9**, wherein the fittings have two parallel extensions with tie rods or cables placed therebetween.

15. The structure of claim **9**, wherein each fitting is connected to each fastening members through tie rods or cables, the tie rods or cables being parallel to the first and second rails and the super galley.

16. A structure for securing an aircraft structure comprising:

a first H-shaped rail extending longitudinally;

a second H-shaped rail extending longitudinally;

a plurality of tie rods to attached the first H-shaped rail and the second H-shaped rail to a frame of an aircraft housing the structure;

a first cross bar having a first end connected to the first H-shaped rail and a second end connected to a first outboard rail; and

a second cross bar having a first end connected to the second H-shaped rail and a second end connected to a second outboard rail;

fastening members connected to the first and second rails;

a fitting connected to the fastening members through tie rods or cables, the fitting having a substantially flat surface contacting the super galley;

a plurality of planer beams extending between the first H-shaped rail and the second H-shaped rail and approximately planer to the super galley.

17. The structure of claim **16**, wherein the first and second H-shaped rails include class 3 size holes, the class 3 size holes configured to receive the tie rods or cables to couple the plurality of cross bars to one of the first cross bar or second cross bar.

18. The structure of claim **16**, wherein the fastening members have two parallel extensions with the tie rods or cables placed therebetween.

19. The structure of claim **16**, wherein the fittings have two parallel extensions with the tie rods or cables placed therebetween.

20. The structure of claim **16**, wherein the tie rods or cables are parallel to the first and second rails and the super galley.

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